

Association between Sleep Quality and Severity of Periodontitis

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ABSTRACT

Background: Periodontal disease severity depends on host response and environmental factors; insufficient sleep is associated with a range of adverse health outcomes that causes decreased immunity and increased inflammatory status.

Aim: The study aims to determine the possible relationship between sleep quality and the severity of periodontitis.

Material & Methods: This is a retrospective study involving patients' records who attended REU periodontics postgraduates' clinics. A total of 80 participants Case-control was identified using the American Academy of Periodontology case definitions for periodontal disease. Periodontitis as the case group (40), healthy & gingivitis as the control group (40). Participants were asked during a phone interview to report age, sex, nationality, socioeconomic status. The quality of sleep was also assessed by Pittsburgh Sleep Quality Index (PSQI). Independent t-test to find the PI, GI, PD, and CAL between gingivitis and periodontitis cases Pearson's correlation test between PSQI and periodontal variables was performed.

Results: The results of our study showed a significant association between poor sleep quality and high periodontitis prevalence 82.5% The mean score of poor sleep quality was high (9.48) among individuals with periodontitis. There was a clear association between periodontal staging and quality of sleep in which the p-value was (0.047). Within the limitations of our study, we conclude that poor sleep quality was significantly associated with the periodontitis stage (severity) PD and CAL. At the same time, the grading showed no statistically significant association with sleep quality. The prevalence of poor quality of sleep was 82.5% in cases (periodontitis group). There was a significant positive correlation between the quality of sleep and CAL $P = 0.012$. In multivariate logistic regression analysis, variables failed to reach a significant level.

Conclusion: Poor sleep quality was significantly associated with the periodontitis stage, while the grading showed no statistically significant association.

Keywords: Periodontitis stage, Prevalence, Sleep quality.

INTRODUCTION:

Periodontal disease is one of the highly prevalent diseases affecting up to 90% of the worldwide population. Periodontal diseases include many inflammatory conditions affecting the periodontium, leading to tooth loss and systemic disease. Periodontal disease severity depends on host response and environmental factors. (1)

Periodontitis is characterized by microbially-associated, host-mediated inflammation that results in loss of periodontal attachment. This is detected as clinical attachment loss (CAL) by circumferential assessment of the erupted dentition with a standardized periodontal probe UNC-12mm, with reference to the cemento-enamel junction. (2)

Periodontal disease severity depends on host response and environmental factors. (3)

According to the International Classification of Sleep Disorders (ICSD-3), insufficient sleep is defined as a curtailed sleep pattern that has persisted for at least three months for most days of the week, along with complaints of sleepiness during the day. Insufficient sleep is associated with a range of negative health and social outcomes. (4)

Sleep deficiency is frequently defined as having less than 6 or 7 hours of sleep, while sleep excess is more than 8 or 9 hours, associated with poor general health. (5)

Lack of sleep is becoming increasingly common nowadays. According to Centers for Disease Control and Prevention (CDC) state-based survey, out of 444,306 responses, only 65% of adults reported a healthy duration of sleep. (6)

Sleep quality is crucial as it may affect periodontitis since the inflammation is characteristic of both periodontitis and poor sleep. (7)

Sleep disturbance is one of the causes of decreased immunity and increased inflammatory status. Both acute and chronic sleep deprivation may activate inflammatory processes leading to increasing C-reactive protein (CRP) concentration, increase peripheral circulation of leukocytes, increase level of interleukin-6 (IL-6), and tumor necrosis factor-alpha (TNF- α). (8)

Sleep deprivation has been documented to increase lymphocyte activation with overproductions of interleukin-1 (IL-1), IL-6, IL-17, and tumor necrosis factor-alpha (TNF- α).

An essential start in finding the source of sleep loss-associated inflammation is a work showing that one night of sleep restricted to four hours, led to increased monocyte production of IL-6 and TNF-alpha messenger RNA. (9)

Elimination and preventing periodontitis need a critical understanding of the causative factors. Many studies show that sleeping is essential for hormone regulation and other functions of the immune system. Inadequate sleeping leads to increased inflammation, among other influences

As many cytokines have a significant role in the pathogenesis of chronic periodontal disease, there might occur potentiation of periodontal destruction in a sleep-deprived individual. In addition, further short sleep duration has been shown to increase pathogen susceptibility and decrease the immunologic protection offered by standard vaccines. (10)

The study aims to investigate and determine the possible relationship between sleep quality and the development of periodontal diseases.

Also, to recognize the factors that may play a significant role, such as age, gender and investigate the possible association between severity of periodontitis and quality of sleep among patients seeking dental care at teaching hospital.

Null-Hypothesis

Poor sleep quality does not affect periodontal disease stages.

Poor sleep quality is not linked to higher levels of inflammation.

Materials and methods:

This is a retrospective study involving patients' records. All the subjects were recruited from the patients who attended periodontics postgraduate students' clinics at Riyadh Elm University last year. (2020-2021)

- Inclusion criteria: Patients completed periodontal examination records included a gingival index; plaque index, periodontal charting, and diagnosis from both genders, and a minimum of 16 natural teeth were present in the dentition. Age group between 18 to 60 years old.
- Exclusions criteria: systemic disease patients. Patients were taking any medication that might affect the prognosis of periodontal tissues, pregnant subjects. Also, any subject received periodontal treatment or antibiotics in the last six months before the record is taken.

Institutional Review Board (IRB) permission was obtained from the REU research center prior to the study. Subjects who accepted participation in the study signed an informed digital consent.

Participants were asked to report age, sex, race, education level, and the economic status during a phone interview. The variables were categorized as follows: age (continuous variable), sex (male, female), race/ethnicity (Saudi and Non-Saudi), and education level (secondary or above; less than secondary level), and economic status (monthly household income <5000; ≥5000 Saudi Riyal (S)).

The periodontal status was assessed on all teeth, excluding third molars through the patient included pocket probing depth (PD) and clinical attachment loss (CAL) in millimeter (mm) at six points per tooth (mesiofacial, midfacial, distofacial, distolingual, midlingual, and mesiolingual). In addition to this, mean plaque index (PI) and mean gingival index (GI) will be recorded for each patient.

Define cases & controls

Eighty subjects classified and diagnosed according to the 2017 Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions. (2)

Cases were the participants diagnosed with periodontitis if interdental clinical attachment loss (CAL) was detected at ≥two non-adjacent teeth, or buccal or oral AL was ≥3 mm with probing depth ≥3 mm was detected at ≥two teeth. The degree of periodontitis was characterized based on stage and grade system. Interdental CAL at the site of most significant loss was used for the definition of four stages. Periodontitis grade based on the assessment of bone loss at the worst affected tooth as a function of age (measured as radiographic bone loss in

percentage of root length divided by the participant's age). Stage classifies severity and the complexity of periodontitis (Stage I-II-III-IV) while the grade is used to estimate the likelihood of case progression (Grade A-B-C). In the presence of certain complexity factors, the stage may be shifted to a higher level. Likewise, in particular risk factors, grade also may be turned to a higher level. (2)

Staging intends to classify the severity and extent of a patient's disease based on the measurable amount of destroyed and/or damaged tissue as a result of periodontitis and to assess the specific factors that may contribute to the complexity of long-term case management. (2)

The participants who did not meet these criteria were considered the control group (no periodontitis). Therefore, we used a 1:1 case-control ratio and included 40 cases with periodontitis and 40 controls.

The Grading aims to indicate the rate of periodontitis progression, responsiveness to standard therapy, and potential impact on systemic health."

If the patient was healthy or had gingivitis, staging and grading do not apply and should not be undertaken. However, if a patient had periodontitis, the disease is staged and graded according to the AAP guidelines.

Assessment of sleep Quality:

Sleep quality was assessed using the Arabic translation version questionnaire of the Pittsburgh Sleep Quality Index (PSQI-A) was sent to all participants by email or WhatsApp.

The PSQI is a valid, reliable, and standardized self-reported questionnaire to measure sleep quality over the last month. The PSQI-A comprises of ten component scores (ranging of subscale scores: 0-3) as follows: 1. Sleep quality 2. Sleep latency, 3. Sleep duration, 4. Habitual sleep efficiency, 5. Sleep disturbance, 6. Use of sleep medication, 7. Day time dysfunction.

Subscale scores of all components were summed to yield a global score (range: 0-21). Higher PSQI scores indicate more inferior sleep quality.

Statistical analysis:

Descriptive analysis was taken and presented as mean, standard deviation, frequency, and percentage. We will use an independent *t*-test to find the PI, GI, PD, and CAL between cases and control. For relationship assessment, univariate and multivariate logistic regression analysis will be performed. All variables except age will be transformed into categorical variables in multivariate analysis. We calculated the odds ratio (OR) and its 95% confidence interval (CI). $P \leq 0.05$ was considered statistically significant. All data were analyzed using statistical software (SPSS v. 24.0 INM, Chicago, IL, USA).

Table 1: Characteristics of the study participants (N=80)

		Gingivitis		Periodontitis		Total	
		n	%	n	%	n	%
Gender	Female	22	55.0%	12	30.0%	34	42.5%
	Male	18	45.0%	28	70.0%	46	57.5%
	Total	40	100.0%	40	100.0%	80	100.0%
Nationality	Saudi	29	72.5%	25	62.5%	54	67.5%
	Non-	11	27.5%	15	37.5%	26	32.5%

Education	Saudi						
	Total	40	100.0%	40	100.0%	80	100.0%
	Secondary	10	25.0%	12	30.0%	22	27.5%
	University	30	75.0%	28	70.0%	58	72.5%
SES	Total	40	100.0%	40	100.0%	80	100.0%
	Low	0	0.0%	1	2.5%	1	1.3%
	Middle	40	100.0%	39	97.5%	79	98.8%
OH	Total	40	100.0%	40	100.0%	80	100.0%
	Good	16	40.0%	11	27.5%	27	33.8%
	Fair	21	52.5%	19	47.5%	40	50.0%
	Poor	3	7.5%	10	25.0%	13	16.3%
Age in years	Total	40	100.0%	40	100.0%	80	100.0%
	Good	16	40.0%	11	27.5%	27	33.8%
	Fair	21	52.5%	19	47.5%	40	50.0%
	Poor	3	7.5%	10	25.0%	13	16.3%
Age in years 34.20±11.54							

Table 2 : Comparison of gingival and periodontal parameters using independent t test

Condition		N	Mean	SD	SEM	t	p
PD	Gingivitis	40	2.23	0.66	0.10	-11.053	<0.001
	Periodontitis	40	5.43	1.71	0.27		
GI	Gingivitis	40	1.39	0.86	0.14	-2.111	<0.001
	Periodontitis	40	1.78	0.78	0.12		
PI	Gingivitis	40	1.08	0.38	0.06	-3.153	<0.001
	Periodontitis	40	1.53	0.80	0.13		
PSQI	Gingivitis	40	6.75	2.89	0.46	-3.123	<0.001
	Periodontitis	40	9.48	4.70	0.74		

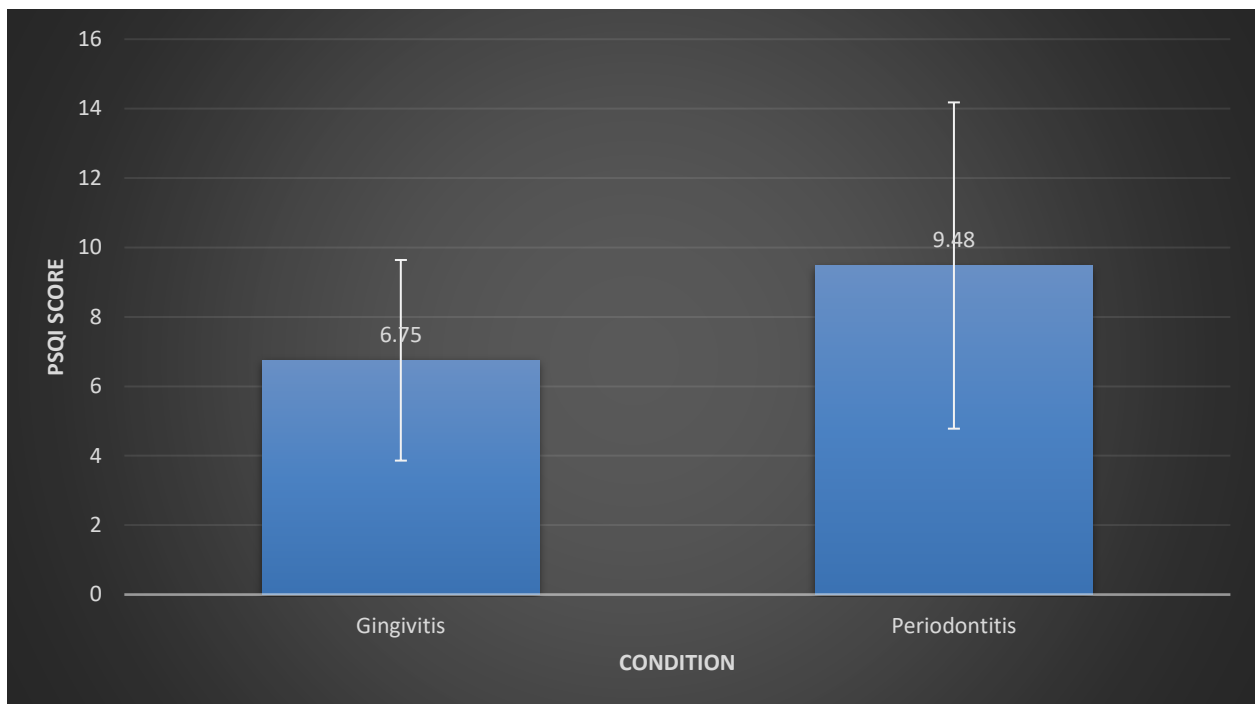


Figure 1: Comparison of PSQI scores between Gingivitis and Periodontitis cases

Table 3: Pearson's correlation between PSQI score and Periodontal variables

Variables	Pearson Correlation	p
PD	0.382**	<0.001
GI	0.161	0.154
PI	0.207	0.065
CAL (Periodontal cases)	0.395*	0.012

* Sig positive correlation.

Table 4: Logistic regression model for selected variables and periodontitis

		B	S.E.	Wald	df	p	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Step 1 ^a	PSQI	-.382	.672	.323	1	.570	.683	.183	2.548
	Gender	.983	.551	3.188	1	.074	2.673	.908	7.864
	Nationality	-.005	.574	.000	1	.993	.995	.323	3.067
	Education	-.641	.614	1.090	1	.297	.527	.158	1.755
	Age	.100	.030	11.167	1	.001	1.105	1.042	1.172
	Constant	-3.107	1.801	2.978	1	.084	.045		

a. Variable(s) entered on step 1: PSQI, Gender, Nationality, Education, Age.

Table 5: Association between periodontal staging and quality of sleep

Staging/Grading		Good sleep		Poor Sleep		p ^s
		n	%	n	%	
Staging	I	2	28.6%	12	36.4%	0.047
	II	4	57.1%	7	21.2%	
	III	0	0.0%	13	39.4%	
	IV	1	14.3%	1	3.0%	
	Total	7	100.0%	33	100.0%	
GRAD E	A	5	71.4%	19	57.6%	0.843
	B	1	14.3%	10	30.3%	
	C	1	14.3%	4	12.1%	
	Total	7	100.0%	33	100.0%	

Fisher's exact test

Discussion:

The purpose of the study was to determine if there was an association of sleep quality and the periodontitis severity.

A total of 80 cases, 40 periodontitis and 40 control (non periodontitis) were enrolled.

The results of our study showed significant association between poor sleep quality and high periodontitis prevalence 82.5%. The mean score of poor sleep quality was high (9.48) among individuals with periodontitis.

There was a clear association between periodontal staging and quality of sleep in which the p-value was (0.047), while gender and age were not significantly associated with periodontitis in accordance with other studies(11, 12), this might be due to the small sample size.

Within the limitations of our study, we conclude that Poor quality of sleep was significantly associated with the periodontitis stage (severity) PD and CAL, study, we conclude that Poor quality of sleep was significantly associated with the periodontitis stage (severity) PD and CAL, while the grading showed no statistically significant association. The results of our study are in agreement with previous studies that stated a possible relation between periodontal disease and poor sleep quality(13, 14). Moreover, in our study sex was not significantly associated with periodontitis in accordance with other studies. Our study fails to reach an association between sex and the development of periodontitis in accordance with other study. (13)

In contrast, one of studies which investigated and assessed the association of sleep deprivation with chronic periodontal disease showed a significant role of the sex in the development of periodontitis(12) furthermore, this study aimed to assess the association between sleep quality and severity of periodontitis and our results showed high mean PSQI in periodontitis group compared to non periodontitis group. This finding is in agreement with another study that showed a PSQI score which was highest in the periodontitis group followed by gingivitis subjects and lowest in healthy subjects and the difference among three groups was statistically significant. (13)

Conclusion:

Our study concluded that poor sleep quality was significantly associated with the periodontitis stage, while the grading showed no statistically significant association.

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